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The Effects of Fathers on Daughters' Expectations for Men

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Abstract

Guided by paternal investment theory (PIT), the current research examines the effects of fathers on daughters' expectations for men in adulthood, and the role of these expectations in mediating women's short-term (casual or uncommitted) sexual behavior. Using a genetically-informed differential sibling-exposure design ($N = 223$ sister pairs from divorced/separated families), we found that developmental exposure to low-quality paternal behavior (but not paternal absence per se) predicted adult women's expectations for men as partners. For older sisters, who spent much of their childhoods living with their fathers, lower-quality paternal behavior predicted lower expectations for male investment in their relationships as adults. Moreover, lower expectations for men as partners predicted higher numbers of sexual partners (past and anticipated) among these women. By contrast, for younger sisters, who spent relatively little time co-residing with their fathers, no such effects of quality of paternal behavior were observed. The current work provides evidence that exposure to low-quality paternal behavior during development may help calibrate daughters' expectations for the behavior of male relationship partners, and these expectations may shape their sexual behavior in adulthood.

Keywords: paternal investment; relationship expectations; father absence; sexual behavior; differential sibling-exposure design

The Effects of Fathers on Daughters' Expectations for Men

A large empirical literature has established replicable associations between a father's behavior and his daughters' sociosexual development. Daughters who grow up with a low-investing father — including those who experience father absence from the home, harsh-coercive fathering, and paternal disengagement — experience earlier average ages of first sexual intercourse, more often become pregnant as teenagers, and enter into sexual relationships with a greater number of partners relative to daughters who grow up with a father who is present and engaged (e.g., Byrd-Craven, Geary, Vigil, & Hoard, 2007; Coley et al., 2009; Ellis et al., 2003; James, Ellis, Schlomer, & Garber, 2012; Quinlan, 2003). Although these relations are generally robust, questions remain regarding: (1) the precise intervening mechanisms through which low paternal investment promotes short-term sexual behavior among daughters; (2) the causal nature of these relations (i.e., associations could be confounded by third variables); and (3) the relative effects of paternal absence versus low-quality paternal behavior on these outcomes.

The current research implements a genetically-informed quasi-experimental design to address these gaps. Specifically, we tested the hypothesis that: (a) women's developmental experiences with their fathers guide their expectations about the behavior of men as parents and partners; and (b) these expectations mediate observed associations between low paternal investment and daughters' short-term sexual behavior (sexual behavior involving multiple short-term, casual, and/or uncommitted partners; e.g., Al-Shawaf, Lewis, & Buss, 2015). We tested this hypothesis in a sample of adult sister pairs from divorced/separated families. We assessed their father's investment during childhood and adolescence (retrospectively reported), as well as their current expectations for men and number of sexual partners. By employing the differential sibling-exposure design (described in detail below), we methodologically controlled for many

environmental and genetic confounds that can affect both the father's behavior and daughters'

relationships with men. Further, this design allowed us to test whether any impact of fathers on

their daughters' expectations and behavior resulted from the amount of father presence versus

absence *per se* (e.g., a dosage effect), or from the interaction between the dosage of father

presence-absence and the quality of paternal behavior (what the father does).

Paternal Investment and its Effects on Daughters' Sexuality and Expectations for Men

As noted above, low father investment is reliably linked with accelerated sexual activity

and reproduction among daughters (e.g., Coley et al., 2009; Ellis et al., 2003; Geary, 2005;

James et al., 2012). These associations can be understood through the lens of paternal investment

theory (PIT; Draper & Harpending, 1982; Ellis, 2004; Ellis et al., 2003, 2012), an evolutionary-

developmental model of fathering rooted in life history theory (e.g., Ellis, Figueredo, Brumbach,

& Schlomer, 2009; Simpson & Belsky, 2008). According to PIT, the investment that daughters

receive from their fathers forecasts the amount or quality of investment that they (and their future

offspring) are likely to receive from male relationship partners in adulthood. These ideas were

originally formulated in a classic paper by Draper and Harpending (1982), which conceptualized

father presence-absence during childhood as a critical contextual factor shaping variation in

daughters' sexual and reproductive behaviors. Building on this idea, Belsky, Steinberg, and

Draper (1991) emphasized the importance of variation in the *quality* of parent-child relationships

(rather than father presence-absence per se) in regulating the development of reproductive

strategies. Ellis (2004) integrated these earlier views, proposing a unique impact of the *quality of*

fathers' (versus mothers') investment on daughters' sexual development and behavior. These

perspectives converge in suggesting that short-term mating strategies function to increase

daughters' reproductive success when long-term male investment is unavailable.

From an integrated PIT perspective, low paternal investment (including, but not limited to, father absence from the home) induces a suite of psychosocial changes in daughters that promote early and short-term sexual behavior. Draper and Harpending (1982) proposed that these changes include: negative attitudes towards men and masculinity (e.g., the belief that men are primarily concerned with maximizing sexual access to multiple female partners); greater sexual interest and less interest in forming a stable, long-term relationship with one man; and the perception that male investment is unreliable and unimportant for reproductive purposes. Recent social psychological research provided experimental support for the effects of fathers (and their behavior) on women's sexual decision making and perceptions of male sexual interest (DelPriore & Hill, 2013; DelPriore, Proffitt Leyva, Ellis, & Hill, 2018). However, the hypothesis that daughters who receive low paternal investment view long-term male investment in partners and offspring to be unreliable and unnecessary has remained largely untested. Relatively low expectations regarding the availability of male investment may be important in directing these daughters toward mating strategies characterized by early and short-term sexual behavior (Ellis et al., 2003, 2012). Such low expectations, moreover, provide modifiable targets for interventions designed to reduce women's risky sexual behavior and its consequences (e.g., unintended pregnancy, sexually transmitted infection).

Here, we posit a model whereby paternal investment (indexed by father presence-absence and the quality of the father's behavior) calibrates daughters' expectations for men. *Expectations for men as parents* refer to women's beliefs about how likely men are to invest in rearing children. *Expectations for men as partners* reflect women's beliefs about how likely men are to invest in them as long-term romantic partners (e.g., providing emotional and financial support) at the expense of pursuing multiple short-term mating opportunities (e.g., having sexual affairs).

Our central hypothesis is that, among young women of reproductive age (operationalized here as 18-36 years of age), expectations for men as parents and partners will: (a) be calibrated based on experiences with fathers while growing up (during childhood and adolescence); and (b) influence number of sexual partners in adulthood (an indicator of risky sexual behavior).

The Differential Sibling-Exposure Design

A second outstanding question in this literature is the extent to which relations between fathers' and daughters' behaviors are accounted for by unmeasured third-variable confounds. For example, research indicates that some of the observed relationships are explained by gene-environment correlations (e.g., Coley, Medeiros, & Schindler, 2008; Harden, 2014; Mendle et al., 2009). Thus, it is critical to consider potential genetic and environmental confounds when testing for "effects" of fathers (their presence-absence/behavior) on daughters' outcomes.

The *differential sibling-exposure design* (originally implemented by Tither & Ellis, 2008; see also, DelPriore, Schlomer, & Ellis, 2017; Ellis, Schlomer, Tilley, & Butler, 2012) minimizes the contributions of such unmeasured confounds and tests for unique effects of experiences with the father within a study that randomizes genetic effects across siblings (as opposed to controlling for genetic relatedness, as in twin or adoption studies). This design compares the outcomes of full biological siblings who were reared together but spent different amounts of time living with their father due to parental divorce/separation followed by primary co-residence with the mother. Daughters in these families experience differential exposures to their father's presence-absence (e.g., if sisters are 7 years apart in age, they get a 7-year differential dosage of this presence-absence). They also experience differential exposures to the father's behavior (e.g., social deviance and warmth/involvement), as daughters spend substantially more time with their fathers when they live together (Ellis et al., 2012).

As outlined by Ellis et al. (2012), the current design tests for the effects of these differential exposures (a measured non-shared environmental effect) on daughters' outcomes. This method is a form of matched-pair design wherein siblings are effectively matched for important and potentially unmeasured environmental factors (e.g., culture, socioeconomic status, religion) by virtue of growing up in the same household. Genetic effects are accounted for through randomization. That is, genetic differences between full biological sisters vary randomly across birth order (parents' alleles are randomly distributed across siblings through meiosis), making older (versus younger) sisters, as a group, equally likely to inherit any given variant.

Finally, the differential sibling-exposure design also can test competing hypotheses regarding the effects of the social address of father presence-absence (i.e., dosage, operationalized as number of years living with/without the father) versus the *quality* of paternal behavior (i.e., whether dosage effects are moderated by quality; see details below). A growing body of research suggests that variation in quality of fathering may drive behavioral differences commonly observed between daughters reared in father-absent versus father-present families (e.g., DelPriore et al., 2017; Ellis et al., 2012). The differential sibling-exposure design enables a genetically and environmentally informed test of whether the effects of paternal presence-absence are conditional upon the quality of paternal behavior.[1]

The Current Study

The current study was designed to: (a) examine the role of paternal investment during childhood/adolescence in calibrating daughters' expectations for male mating and parental behavior in adulthood; and (b) test these expectations as mediating the relation between paternal investment and women's number of sexual partners (past and anticipated). We also examine the

role of the social address of father presence-absence versus the role of continuous variation in the

quality of paternal behavior in shaping the hypothesized differences in daughters' expectations.

First, we tested two predictions focused on the "social address" hypothesis. Specifically,

we tested whether younger sisters (who, as a group, received a larger dose of father absence

while growing up) would report lower expectations for men than do their older sisters (who, as a

group, received a smaller dose of father absence). This finding would suggest a causal (main)

effect of father presence-absence on daughters' expectations. We further tested whether this

main effect was conditioned by dosage. This necessitated testing the two-way interaction

between the main effect of father presence-absence (operationalized as older vs. younger sister)

and differential dosage of father presence-absence (operationalized as the difference in the

number of years that sisters lived with their father). The causal hypothesis is that differences

between younger and older sisters' expectations for men will be greatest among sisters separated

by a large age gap (thus maximizing their differential exposure to father presence-absence).

Second, we tested two predictions focused on the "quality of paternal behavior"

hypothesis. The effects of fathers have been shown to depend on what fathers do while in the

home (e.g., Jaffee, Moffitt, Caspi, & Taylor, 2003; Tither & Ellis, 2008). Accordingly, the

effects of father presence-absence on daughters should be moderated by the quality of paternal

behavior. Within the current design, this hypothesis can be evaluated by testing the two-way

interaction between father presence-absence and quality of paternal behavior. Specifically, the

effects of quality of paternal behavior on daughters' expectations for men should be stronger in

older than in younger sisters, since older sisters received a larger dose of their father's behavior.

If this hypothesis was supported, it would suggest a causal effect of the quality of paternal

behavior (as opposed to father presence-absence per se) on daughters. Further, we tested whether

the proposed two-way interaction was conditioned by the *size* of the age gap between sisters, as has been found in recent empirical studies (e.g., DelPriore et al., 2017; Ellis et al., 2012). This necessitated testing for a three-way interaction between the main effect of father presence-absence, quality of paternal behavior, and age gap. The causal hypothesis is that differences in the effects of paternal behavior on older and younger sisters will be greatest when there is a large age gap between sisters (thus maximizing their differential exposure to paternal behavior).

Finally, we build on the results of these genetically-informed models to test whether women's expectations for men statistically mediate the relation between paternal investment (father presence-absence and/or quality of paternal behavior) and daughters' number of sexual partners. In the context of the differential sibling-exposure design, we tested for moderated mediation to allow indirect effects (paternal investment → women's expectations for men → number of sexual partners) to vary across older and younger sisters.

Method

Procedures and Participants

This study was reviewed and approved by the University of Arizona Institutional Review Board (protocol number: 1300000470; title: The impact of fathers on risky sexual behavior and decision-making in daughters). Participants were recruited online over a one-year period. We actively recruited full biological sister pairs who: 1) were at least four years apart in age; 2) were between ages 18 and 36 at the time of data collection; and 3) experienced the divorce/separation of their parents before the younger sister turned age 14. Potential participants (and their sisters) completed a brief screening questionnaire via telephone. Once it was determined that a sister pair met inclusion criteria, each sister was electronically mailed a link to an online Qualtrics (Provo, UT) survey. Of the 628 pairs invited to participate, 274 (43.6%) were successfully recruited into

the study (i.e., both sisters completed surveys). Women from qualifying families in which both

sisters participated reported higher paternal and maternal educational attainment compared to

qualifying families that did not participate (i.e., data from one or both sisters were completely

missing). Due to known concerns regarding the validity of data collected online (e.g., Goodman,

Cryder, & Cheema, 2012), responses provided by the 274 sister pairs were carefully screened.

Based on this screening, 51 families were omitted prior to data analysis. Families included in

versus excluded from analysis did not differ in their reported socioeconomic status, parental

education, ethnicity, or age gap between sisters.

The final analytic sample included adult sister pairs from 223 families ($N = 446$

individuals). At the time of data collection, the mean age was 29.50 years ($SD = 3.94$, range 22-

38[2]) for older sisters and 23.85 years ($SD = 3.78$, range 18-32) for younger sisters. Using sisters'

birthdates, the average age difference between sisters was calculated to be 5.65 years ($SD = 1.78$,

min = 3.45[2], max = 12.78). At parental separation/divorce, the average age was 11.34 ($SD =

4.13$; range 3-23) for older sisters and 5.74 ($SD = 3.71$; range 0-14) for younger sisters. Sample

participants primarily self-identified as non-Hispanic white (66.1%), Hispanic/Latina (11.7%),

non-Hispanic black (11.0%), or multiracial (9.9%). Regarding participants' current marital

status, 62.5% were single, 28.8% married, 8.5% divorced/separated, and 0.2% widowed. The

sample included women who self-identified as heterosexual (81.6%), bisexual (12.4%),

homosexual/lesbian (1.1%), and other (e.g., pansexual, queer, asexual; 4.9%)[3]. During

prescreening, most participants indicated that they were poor or lower middle class while

growing up (53%), with fewer reporting being middle class (36%) or upper middle class/wealthy

(11%). (See Supplemental file 1 for additional details regarding participant recruitment,

exclusion criteria, and sociodemographic characteristics, and Supplemental file 2 for statistical

comparisons between families based on participation and inclusion status.)

Measures

     This study included measures assessing sisters': quality of paternal behavior during

childhood/adolescence[4]; current expectations for men as parents and partners; and numbers of

sexual partners in adulthood. We report all measures collected to assess these three domains.

(See Supplemental file 3 for the full lists of items included in these measures.)

     Quality of paternal behavior (childhood/adolescence). We indexed the role of fathers

at three levels: (1) presence-absence from the home; (2) social deviance inside and outside of the

home; and (3) warmth and involvement (e.g., the quality of father-daughter relationships).

Although the social deviance measure indexes paternal behavior more generally rather than

directly in relation to the daughters, previous research suggests that exposure to antisocial

paternal behavior has significant negative effects on child behavior (Blazei, Iacono, & McGue,

2008; Jaffee et al., 2003). To compare the experiences of older and younger sisters during the

same developmental stages, the current design necessitated a retrospective assessment of parental

behavior. (We discuss the use of retrospective measures as a limitation in the Discussion.)

     Paternal social deviance. We measured perceptions of the father's social

deviance/psychopathology using a 23-item checklist that included possible behavioral and mental

health problems demonstrated by the father[5] (from relatively mild to severe; e.g., Tither & Ellis,

2008). Participants were prompted to consider their childhood up to age 18 while responding to

these questions (e.g., "Did your birth father have trouble with drug abuse?"; $-1 = no, 0 = don't$

know, $1 = yes, 2 = yes, a lot$). A composite score was computed by averaging the items ($\alpha = .94$;

$M = -.30$, $SD = .63$; min $= -1$, max $= 1.74$), and higher scores reflect higher levels of paternal

social deviance. Mean scores on the final measure were -.31 (SD = .64) for older sisters and -.30

(SD = .62) for younger sisters. Older and younger sisters' scores were strongly positively

correlated (r = .75, p < .001) within families.

   Father warmth/involvement. We used two measures to assess warm/involved fathering.

First, we measured fathers' direct involvement in their daughters' lives using the 8-item

Responsible Paternal Engagement subscale of the Fatherhood Scale (Dick, 2004). Participants

were asked to think about their birth father during their first 16 years of life and rate how often

he was involved in various activities (e.g., "My father helped me with my homework"; 1 =

never; 5 = *always*). A composite score was computed by averaging the items (α = .91; M = 2.33,

SD = 1.04; min = 1, max = 5). Higher scores reflect more direct father involvement (older sisters:

M = 2.45, SD = 1.05; younger sisters: M = 2.20, SD = 1.01).

   Second, we measured the quality of the relationships that daughters had with their fathers

while growing up (Ellis et al., 2012). This measure included 12 items assessing warm-supportive

fathering using the care subscale of the Parental Bonding Inventory (PBI; Parker, Tupling, &

Brown, 1979) and 4 items assessing harsh-coercive fathering from the Conflict Tactics Scale

(Jouriles, Mehta, McDonald, & Francis, 1997; Straus, 1979). Participants rated their father

during their first 16 years of life (1 = *very unlike*, 4 = *very like*). Items were averaged to form

composite measures of warm-supportive (M = 2.53, SD = .84; α = .94) and harsh-coercive (M =

1.73, SD = .87; α = .86) fathering. Warm-supportive and harsh-coercive (reverse coded)

fathering scores were standardized across birth order. These scores strongly correlated (r = .58)

and thus were averaged to form a measure of father-daughter relationship quality (M = .00, SD =

.89; min = -2.21, max = 1.29). Higher scores reflect higher quality relationships (older sisters: M

= -.06, SD = .90; younger sisters: M = .06, SD = .87).

The two fathering measures (direct father involvement and father-daughter relationship quality) were correlated ($r = .56$, $p < .001$). Therefore, we standardized and averaged these scores together into a composite measure of *father warmth/involvement*. This final measure was grand-mean centered via standardization (older sisters: $M = .03$, $SD = 1.02$; younger sisters: $M = -.03$, $SD = .98$), with higher scores reflecting more warm/involved fathering. The convergence between older and younger sisters on this measure ($r = .57$, $p < .001$) supports the validity of the current method of assessing fathering quality.

To test discriminative predictions, participants also rated their mother (i.e., her involvement and mother-daughter relationship quality) using similar measures ($M = .00$, $SD = .88$; min = -.2.81, max = 1.36). The final score (*mother warmth/involvement*) was standardized, and mean scores were -.07 ($SD = 1.02$) for older sisters and .07 ($SD = .98$) for younger sisters. These scores also were positively correlated ($r = .49$, $p < .001$) within families.

Expectations for men as parents. Women's expectations for men as parents were assessed using an adapted version of the 14-item Perception of Father's Involvement Scale from the Father Presence Questionnaire (FPQ; Krampe & Newton, 2006), a valid measure of adults' childhood experiences with their fathers. The instructions and items were modified for the current study to index women's expectations that men become actively involved in their children's lives (e.g., how likely men are to "help their children learn new things"; 1= *not at all likely*; 7= *extremely likely*). Women were instructed to respond based on their life experiences with men, rather than reporting on the behavior of a specific male partner. Appropriate items were reverse-scored, and a composite score was computed by averaging the 14 items ($\alpha = .97$; $M = 5.36$, $SD = 1.18$; min = 1.36, max = 7). Higher scores reflect higher expectations for men's

parental behavior. Mean scores were 5.40 ($SD = 1.15$) for older and 5.33 ($SD = 1.20$) for younger

sisters. These scores were not correlated ($r = .05$, $p = .47$) among sisters.

Expectations for men as partners. A measure of women's expectations for potential

relationship partners was constructed for the present study, including items adapted from

previously published scales. The Lund (1985) Investment Scale was modified to assess women's

perceptions of men's likelihood of investing emotionally and financially in long-term

relationships (rather than participants' own investment in a current relationship). The Ellis

(1998) Investment Inventory was modified to derive items assessing perceptions of men's

likelihood of engaging in behaviors characteristic of short-term mating effort (e.g., lying, having

sex with other women). (See Table 1 for full list of items.) Putting these items together, this

measure was constructed to capture women's expectations independent of their current age or

relationship/marital status. To this end, participants received the following instructions:

> *Imagine that you are single and looking for a relationship. Think about the pool of men*
>
> *who you could potentially date. Realistically, how likely is a potential dating partner to*
>
> *do the following things?*

Ratings were made on a 5-point scale (1 = *Not at all likely*; 5 = *Extremely likely*).

Appropriate items were reverse scored, and a composite score was computed by

averaging the 14 items ($\alpha = .91$; $M = 3.85$, $SD = .72$; min = 1.36, max = 5.00). Higher scores

reflect higher expectations for men as partners (i.e., more male investment, less profligate

behavior). Two outliers (low scores) were truncated to produce a continuous distribution upon

visual inspection (truncated min = 1.55)[6]. Mean scores on the final measure were 3.82 ($SD = .73$)

for older sisters and 3.88 ($SD = .69$) for younger sisters. Scores were not significantly correlated

between older and younger sisters ($r = .07$, $p = .30$).

This study also included a measure of women's general beliefs about men's marital role

commitment that is indirectly relevant to testing the central hypothesis. This measure is

described, and analyses presented, in Supplemental file 5.

Number of sexual partners (adulthood). To test the proposed mediation models, the

current study required an assessment of women's sexual behavior. We thus asked women to

report on their past and anticipated numbers of sexual partners. To minimize age-related

confounds, participants reported the number of different partners they had sex with in the past

year (i.e., the year prior to the study; Simpson & Gangestad, 1991). To reduce the influence of

outliers and skewness often obtained on open-response measures of this kind (e.g., Jackson &

Kirkpatrick, 2007), these responses were recoded: 0 = *none*, 1 = *one*, 2 = *two to three*, 3 = *four to*

six, 4 = *seven or more*. On this scale, the average score was 1.33 (*SD* = .84). Mean scores were

1.32 (*SD* = .82) for older sisters and 1.33 (*SD* = .87) for younger sisters.

Women also reported the number of different partners they foresee themselves having sex

with during the next five years, and the number of different sexual partners they would like to

have in the next year, ten years, and the rest of their lives (Buss & Schmitt, 1993; Simpson &

Gangestad, 1991). Again, each item was recoded[7] to reduce skew and to produce an

approximately normal distribution in the current sample. The four recoded items were

standardized and averaged to form a composite index of women's anticipated number of sexual

partners (*α* = .91; *M* = .001, *SD* = .89, min = -1.60, max = 3.60). Mean scores were -.02 (*SD* =

.86) for older sisters and .02 (*SD* = .92) for younger sisters.

To index women's *number of sexual partners*, the measures assessing their numbers of

sex partners in the past year and their anticipated future sex partners[8] were each standardized

before being averaged together (*r* = .41). Mean scores on this composite measure were -.01 (*SD*

= .83) for older sisters and .01 (SD = .84) for younger sisters. These scores were moderately

correlated (r = .22, p = .001) among older and younger sisters. Although there is no gold

standard available to validate self-reports of sexual behavior, previous work supports their

validity (Dunne et al., 1997; Hamilton & Morris, 2010).

Data Analysis

To test our main hypothesis, we first tested a series of multilevel regression models.

Following procedures outlined by Ellis et al. (2012) and DelPriore et al. (2017), we modeled the

non-independent (correlated) errors inherent in data collected from sisters reared together (Kenny,

Kashy, & Cook, 2006). To this end, we used a technique for cross-sectional distinguishable dyads

(Campbell & Kashy, 2002; Kenny et al., 2006). For the fixed predictor portion of the model, this

technique uses a single dyad-level intercept. For the error covariance portion, this technique

specifies within-dyad correlated residuals. We included a dummy coded fixed-effect variable (0 =

older; 1 = *younger*) to model differences between sisters within families.

As stated in previous work using this design (DelPriore et al., 2017; Ellis et al., 2012), this

approach: (1) allows for categorical and continuous predictors; (2) models within-family effects

(older vs. younger sister; quality of paternal behavior experienced by each sister), between-family

effects (differential exposure between sisters), and their interactions; and (3) adjusts outcome

scores for measurement error (Sayer & Klute, 2005). For this analysis, the *lme* function in the R

version 3.3.1 *nlme* package was used to specify a compound symmetric residual covariance

structure for sisters nested within families. Having adjusted for correlated residuals within

families, hypotheses were tested using fixed effect models similar to multiple regression.

<div align="center">Results</div>

Bivariate Correlations

As the measures of "expectations for men as parents/partners" were developed for this study, it is important to establish their construct validity in terms of expected relations with other variables. As shown in Table 2, for older sisters who spent most of their childhoods living with their fathers, greater paternal social deviance was associated with lower, whereas greater paternal warmth/involvement was associated with higher, expectations for men as both parents and partners. For both older and younger sisters, greater expectations for men as partners was positively correlated with greater expectations for men as parents. In total, the expectations measures performed the way they were supposed to.

Within-Family Analyses

We tested the main predictions in a series of models[9] that build in complexity and account for genetic and family-wide confounds. First, we examined the relationship between exposure to father presence-absence and women's expectations for men irrespective of the quality of the father's behavior, using birth order and the age gap[10] between sisters as indices of differential exposure (the "social address" hypothesis). Next, we tested whether the predicted relationship between quality of paternal behavior and expectations for men was stronger among daughters who experienced greater exposure to their fathers' behavior while growing up, again using birth order and age gap to index differential exposure between sisters (the "quality" hypothesis). Finally, we tested expectations for men as an intervening mechanism in the relationship between paternal investment and women's sexuality. Based on the results of the genetically-informed models, bootstrapping procedures were used to test for indirect effects of paternal behavior on older and younger sisters' number of sexual partners through their expectations for men (i.e., moderated mediation). We summarize the hypotheses tested, and whether they were supported, in Table 3.

Exposure to paternal presence-absence (the "social address" hypothesis). To test the effects of differential exposure to father presence-absence, we tested two models. First, we tested for main effects of birth order on women's expectations. There were no statistically significant main effects of birth order on women's expectations for men as parents ($p = .52$) or as partners ($p = .34$). Second, we tested for interactions between birth order and daughters' amount of differential exposure to father presence-absence (in years) to determine whether effects of father presence-absence were revealed only when the younger sister experienced a much larger dose of exposure to this absence than did her older sister. The two-way interactions predicting women's expectations for men as parents ($p = .72$) and partners ($p = .91$) were not significant. These results failed to support the "social address" hypothesis and suggest that daughters' expectations for men were not calibrated based on exposure to their fathers' *presence versus absence* per se.

Exposure to paternal behavior (the "quality" hypothesis). Next, we tested if the effects of fathers on daughters' expectations for men depends on the interaction between father presence-absence and the *quality* of the father's behavior. We first tested if older sisters demonstrate a stronger relationship between the quality of paternal behavior they experienced and their expectations for men as a result of their greater exposure to the father (relative to their younger sisters). To test this prediction, we included in our models the two-way interaction between quality of paternal behavior (social deviance and warmth/involvement) and birth order (older vs. younger sisters). Next, we tested whether the predicted effects would be further moderated by sisters' amount of differential exposure to the father. This involved testing the three-way interactions between quality of paternal behavior, birth order, and age gap.

Paternal social deviance. The two-way interaction between paternal social deviance and birth order on women's expectations for men as parents was not statistically significant, $F(1,$

207) = .95, p = .33. However, this model revealed a significant main effect of paternal social

deviance across birth order, such that daughters' expectations for men as parents decreased as

their father's socially deviant behavior increased, b = -.17 (SE = .05), $t(209)$ = -3.54, p < .001.

(See Table S1 in Supplemental file 6 for full model results.)

Regarding women's expectations for men as partners, there was a significant two-way

interaction between paternal social deviance and birth order, $F(1, 218)$ = 5.56, p = .02 (see Table

4). Simple slope tests revealed that among older sisters, more deviant paternal behavior predicted

lower expectations for men as partners, b = -.19 (SE = .07), $t(218)$ = -2.97, p = .003; no

association between paternal social deviance and these expectations was found among younger

sisters, b = .02 (SE = .07), $t(218)$ = .30, p = .76. Further, older sisters exposed to more deviant

paternal behavior (1 SD above the mean) reported significantly lower expectations for male

partners relative to younger sisters, b = .30 (SE = .13), $t(218)$ = 2.36, p = .02 (Figure 1).

However, older and younger sisters' expectations did not significantly differ when exposed to

average (mean) or low (1 SD below the mean) paternal social deviance, ts ≤ |.99|, ps ≥ .32.

Following recommendations by Roisman and colleagues (2012), we examined regions of

significance (RoS) on paternal social deviance using an online resource

(http://www.quantpsy.org; Preacher, Curran, & Bauer, 2006). The upper bound for RoS on

paternal social deviance was .53 SD, with older sisters reporting significantly lower expectations

for men as partners than younger sisters when paternal deviance was .53 SD above the mean (or

beyond). The lower bound for RoS on paternal social deviance was -3.21 SD.

Father warmth/involvement. The two-way interaction between father

warmth/involvement and birth order on women's expectations for men as parents was not

significant, $F(1, 207)$ = .47, p = .49. Again, there was a significant main effect of father

warmth/involvement across birth order, such that daughters' expectations for men as parents increased with their father's warmth/involvement, $b = .30$ ($SE = .05$), $t(209) = 6.38$, $p < .001$. (See Table S1 in Supplemental file 6 for full model results.)

Regarding women's expectations for men as partners, the model revealed a marginally significant two-way interaction between father warmth/involvement and birth order, $F(1, 218) = 2.91$, $p = .09$ (see Table 4). Because of known difficulties in detecting statistical interactions in regression analyses using continuous variables (McClelland & Judd, 1993), Aiken and West (1991) recommend interpreting marginally significant interaction effects when clearly predicted by theory. Given that this interaction was a prediction of PIT, we interpret it here. The pattern of results obtained for father warmth/involvement converged with those obtained for paternal social deviance. Among older sisters, more warm/involved fathering predicted higher expectations for men as relationship partners, $b = .16$ ($SE = .07$), $t(218) = 2.39$, $p = .02$; again, no association was found among younger sisters, $b = -.001$ ($SE = .07$), $t(218) = -0.01$, $p = .99$. Older sisters who experienced low father warmth/involvement (-1 SD) reported marginally lower expectations for men as partners relative to younger sisters, $b = .25$ ($SE = .13$), $t(218) = 1.93$, $p = .055$ (Figure 2). However, older and younger sisters' expectations did not significantly differ when exposed to average (mean) or high (+1 SD) levels of father warmth/involvement, ts $\leq |1.01|$, ps $\geq .31$.

Again, we examined regions of significance on father warmth/involvement (Preacher et al., 2006; Roisman et al., 2012). Older sisters reported lower expectations for men as partners than younger sisters when father warmth/involvement was between 1.34 and 2.07 SD below the mean. This result suggests that older sisters' greater (average) exposure to fathers who were high or moderate in warmth/involvement did not have a meaningful (positive) impact on their

expectations. Only at very low levels of warmth/involvement (1.34 *SD* below the mean) did greater exposure to the father decrease older (vs. younger) sisters' expectations for male partners.

Differential dosage of exposure to paternal behavior quality (in years). Finally, we tested for dose-response relationships using a more fine-grained index of differential exposure to paternal behavior: differences in the amount of time that sisters spent living with their fathers. These models test whether the interaction between quality of paternal behavior and birth order is conditioned by the *amount* of differential exposure to the father measured in years[10]. Adding this variable to the model necessitated testing three-way interactions between: 1) quality of paternal behavior; 2) birth order (older vs. younger); and 3) sisters' differential exposure to their fathers (in years). These models included all main effects and constituent two-way interactions.

The three-way interactions between paternal social deviance, birth order, and amount of differential exposure to the father were not significant: expectations for men as parents, $F(1, 204) = .53$, $p = .47$; and expectations for men as partners, $F(1, 215) = .12$, $p = .73$. The interactions between father warmth/involvement, birth order, and amount of differential exposure were not significant: expectations for men as parents, $F(1, 204) = .39$, $p = .53$; and expectations for men as partners, $F(1, 215) = .12$, $p = .73$. The null three-way interactions suggest that the *amount* of differential exposure to fathers – though a finer grained metric – did not provide predictive power above and beyond differential exposure to the father as indexed by sisters' birth order.

Tests of model fit. Including sisters' amount of differential exposure to their fathers (a family-level variable) introduced cross-level interactions into our models. Power to detect these effects depends on sample sizes at both Levels 1 and 2 (Mathieu, Aguinis, Culpepper, & Chen, 2012). Although the number of families (Level 2) in our sample was adequate (Du & Wang, 2016), power to detect cross-level interaction effects was likely limited by the designed focus on

dyads at Level 1 (Mathieu et al., 2012). It is therefore possible that the null three-way

interactions resulted from a lack of statistical power, as opposed to true null effects in the

population. To explore this possibility, we compared the relative fit of our models using deviance

statistics (following recommendations by Singer & Willett, 2003). Specifically, we compared

models testing for two-way interactions between quality of paternal behavior and birth order

against models testing the respective three-way interactions. Since the models were nested and

differed only in their inclusion/exclusion of the differential exposure variable, we computed

sample log-likelihood (LL) statistics and conducted likelihood ratio (L-ratio) tests to compare

relative model fits. These tests, in combination with the AIC/BIC statistics, suggested that

including the amount of differential exposure (in years) did not significantly improve the fit of

any of the tested models, consistent with the null results presented above. (See Supplemental file

7 for full results.) It is worth noting that these tests consistently favored models testing the two-

way interaction between paternal quality and birth order as the highest-order interaction over

models testing for main effects of birth order or the expanded three-way models. Therefore, it

remains possible that we did not have adequate power to detect some of the predicted two-way

interaction effects. We recommend caution when interpreting the null two-way interactions

between quality of paternal behavior and birth order on women's expectations for men as *parents*

obtained here.

  Moderated mediation model. From a PIT perspective, an important next step is to test

whether expectations for men statistically mediate the relationship between paternal investment

during childhood/adolescence and daughters' sexual behavior in adulthood[11]. The genetically-

informed models provided the strongest support for paternal social deviance adjusting women's

expectations for men as *partners*. Therefore, we focused on paternal social deviance as the

predictor (X) and women's expectations for men as partners as the proposed mediator (M) in this model. Given the demonstrated effect of sisters' differential exposure to the father as indexed by birth order on this relationship, we included birth order as a moderator (W) of this pathway (i.e., the *a* path). The outcome (Y) variable was women's number of sexual partners (see Figure 3).

We used Hayes' (2013) PROCESS SPSS macro (version 2.16.2; Model 7) to assess whether the indirect effect of paternal social deviance on women's number of sexual partners through their expectations for men as partners was significantly different from zero (Preacher & Hayes, 2008), and whether the mediational pathway was moderated by birth order (i.e., whether the indirect effect differed across older and younger sisters). Following recommendations outlined by Preacher and Hayes (2004), we collected 10,000 bootstrapped samples to generate bias-corrected 95% confidence intervals for each indirect effect (the paths through the mediator).

Consistent with the above analyses, the effect of paternal social deviance on women's expectations for men as partners was moderated by birth order (two-way interaction: $\beta = .15$ [$b = .21$, $SE = .09$], $t = 2.27$, $p = .02$). In turn, there was a significant effect of women's expectations for men as partners on their number of sexual partners, controlling for paternal social deviance, $\beta = -.21$ ($b = -.21$, $SE = .05$), $t = -4.51$, $p < .001$. Women who had lower expectations for men as partners reported more sexual partners (past and anticipated). The relationship between paternal social deviance and number of sexual partners was mediated by these expectations for older sisters. This indirect pathway was not significant among younger sisters (see Figure 3). The results suggest that exposure to deviant paternal behavior may increase women's short-term sexual behavior by reducing their expectations for male investment in relationships, but only among daughters who spent a substantial period of time being exposed to the father's behavior (in this sample, older sisters, who co-resided with their fathers for an average of 11 years).[12, 13]

Unique Effects of Quality of Paternal (Versus Maternal) Behavior

Given the current theoretical framework, it is important to examine the specificity of the demonstrated effects to fathers (beyond the effects of mothers). To this end, we retested the main finding obtained in the genetically-informed models – the two-way interaction between paternal social deviance and birth order on women's expectations for men as partners – while controlling for the quality of maternal behavior (i.e., mother warmth/involvement). The pattern of results persisted: 2-way interaction: $F(1, 217) = 4.84$, $p = .03$; simple slope for older sisters: $b = -.18$ ($SE = .07$), $t(217) = -2.72$, $p = .007$; main effect of birth order at 1 SD above the mean on paternal social deviance: $b = .27$ ($SE = .13$), $t(217) = 2.09$, $p = .04$. However, the two-way interaction between mother warmth/involvement and birth order controlling for paternal social deviance was not significant: $F(1, 217) = .04$, $p = .83$. The results suggest a unique effect of differential exposures to low quality paternal (versus maternal) behavior on daughters' expectations for male partners in adulthood.

Discussion

In recent decades, reliable associations between low paternal investment (including biological father absence and low-quality fathering) and daughters' early and short-term sexual behavior have been consistently demonstrated (e.g., Coley et al., 2009; James et al., 2012; Quinlan, 2003). Guided by an evolutionary-developmental perspective, the current work tested the effects of fathers on daughters' expectations for men as parents and as partners, and the potential role of these expectations in shaping the risky sexual behavior observed in contexts characterized by low paternal investment. We found that daughters exposed to low-quality paternal behavior (particularly, the father's socially deviant behavior) while growing up, but not father absence *per se*, reported lower expectations for the investment they were likely to receive

from male relationship partners in adulthood. This effect was specific to women who experienced relatively large doses of exposure to their father and his behavior (in the current sample, older sisters from divorced/separated families). Women with lower expectations for male partners, in turn, reported having and anticipating more sexual partners as adults.

This work provides support for the role of fathers in shaping their daughters' expectations for men as partners, and establishes these expectations as a potential mediator of the relationship between low paternal investment and daughters' short-term sexual behavior. In their seminal paper, Draper and Harpending (1982) predicted unique effects of fathers on daughters' beliefs about the availability and importance of male investment for reproduction. The current work suggests that daughters with greater exposure to low-quality paternal behavior may lower their expectations for receiving long-term investment from male relationship partners, and these lowered expectations may promote more short-term sexual behavior.

Although there are likely myriad intervening biosocial mechanisms linking paternal behavior to daughters' sexual and reproductive behavior, the current results link increased female sociosexuality in this context to changing expectations about men. Such a shift in women's beliefs could facilitate women's willingness to pursue short-term or multiple relationships with men as a means of securing "good gene" indicators (e.g., physical attractiveness) for future offspring (Vigil, Geary, & Byrd-Craven, 2006), given these men's inclination for low investment (Booth & Dabbs, 1993). Alternatively, women's increased sociosexuality in this context may function to facilitate a genetic bet-hedging strategy (Hill, Prokosch, & DelPriore, 2015), secure immediate access to financial resources (Vigil et al., 2006), or (at a more proximate level) satisfy a desire for intimacy (Cooper, Shapiro, & Powers, 1998). Though elucidating the perceived benefits available to women from short-term mating

when male investment is low was not our central focus, the current work suggests a potential role of fathers in shaping daughters' expectations for male investment and related sexual behavior.

The observed pattern of results also supports a causal effect of exposure to low-quality paternal behavior on daughters' expectations for men as partners. We tested our primary hypothesis by comparing the experiences and outcomes of full biological sister pairs who grew up in the same home but who spent different amounts of time co-residing with their father due to parental separation/divorce. This differential sibling-exposure design controls for many shared environmental confounds and randomizes genetic risk across siblings, effectively isolating the effects of dosage of paternal exposure/behavior (non-shared environment) in shaping daughters' outcomes. Within this context, we found effects of differential exposure to low-quality paternal behavior on daughters, with older sisters' expectations decreasing as a function of the quality of paternal behavior. No effects of quality of paternal behavior were found for younger sisters, who spent relatively little time with their fathers in the home (being directly exposed to this behavior). These within-family differences cannot be accounted for by unmeasured shared environmental and genetic factors that confound many between-family study designs (for example, differences in socioeconomic status, race/ethnicity, mothering quality, or genetic susceptibility). Although past research implementing this design found that differences in the effects of fathering quality on daughters' sexual behavior only manifested within families in which the sisters were separated by a large age gap (i.e., families in which sisters' differential exposure to the father was maximized; e.g., Ellis et al., 2012), it is unknown why this large gap was not necessary to detect differences between sisters in the current study.

The current findings provide support for low-quality paternal behavior exerting a stronger (unique) impact on daughters than father absence from the home. We found no effects of 5.6

additional years of exposure to father presence versus *absence* on older versus younger sisters'

expectations, without taking into account the quality of paternal behavior. Little previous

research has considered the independent effects of exposure to low-quality fathers and exposure

to father absence per se, as these conditions naturally co-vary. These results are consistent with

recent work revealing effects of fathering quality (but not father absence) on daughters' risky

sexual behavior (Ellis et al., 2012) and affiliation with sexually promiscuous peers (DelPriore et

al., 2017), with older sisters being more strongly influenced than their younger sisters. This

finding also is consistent with work demonstrating effects of exposure to deviant paternal

behavior in shaping children's conduct problems (e.g., Jaffee et al., 2003). In total, when

environmental and genetic confounds that affect both fathers' and daughters' behaviors are

accounted for, it appears that the father's behavior while living in the home (rather than his

absence per se) has the strongest influence on his daughters' sexual behavior.

Finally, we did not find support for the causal hypothesis linking paternal investment and

daughters' expectations for men as *parents* (that is, men's active involvement in childrearing).

Although, as noted above, it is possible that we did not have adequate statistical power to detect

some of the predicted interaction effects, we did find main effects of the quality of paternal

behavior on these expectations across sisters. Women who experienced low-quality paternal

behavior (high social deviance, low warmth/involvement) reported lower expectations for men as

parents. In the context of the null interaction effects, this result may suggest that the relationship

between quality of paternal behavior and women's expectations for men as parents derive from

genetic or environmental confounds. That is, families characterized by low- versus high-quality

paternal behavior may differ in ways outside of the fathers' behavior (e.g., genetic,

sociodemographic, or cultural differences) that shape daughters' expectations for men's parental

behavior. Taken together, the current findings reveal an association between quality of paternal behavior and daughters' expectations for men as parents, but do not provide support for paternal behavior *causing* changes in these expectations.

Practical Significance, Limitations, and Future Directions

The current work suggests the importance of paternal behavior in shaping daughters' expectations for their relationship partners, which provides a modifiable target for interventions attempting to reduce risky sexual behavior. This finding also is noteworthy as cohabitation rates rise in the United States (Cohen & Manning, 2010). Identifying factors that shape individuals' expectations for their relationships (including the behavior of the father) may be critical in understanding which romantic relationships are likely to dissolve or endure, and how low paternal investment is transmitted socially across generations (McLanahan & Bumpass, 1988).

Although the current work is poised to contribute to the theoretical and empirical developmental literature on the effects of fathers, there are important limitations to note. First, the current study relied on retrospective reports to assess quality of parental behavior and thus raises concerns related to validity. Retrospective measures of adverse childhood experiences are subject to biased reporting (including high rates of false negatives) and do not consistently correlate with prospective reports (Hardt & Rutter, 2004; Reuben et al., 2016). Further, according to Hardt and Rutter (2004), assessments that ask adult participants to recall subtle and subjective aspects of their childhood experiences may be less accurate than assessments of more concrete adverse events. Although comparing retrospective reports provided by siblings (as we have done here) can help establish validity, inter-rater agreement may be inflated as siblings discuss their experiences over time. In the current work, we used retrospective measures assessing a range of women's childhood experiences related to their parents. However, it remains

possible that the paternal social deviance measure (which collects information on adverse events such as the father's drug abuse and attempted suicide) constitutes a more objective (and thus valid) assessment than the measure of parental warmth/involvement, which relies on more subjective interpretations of parental quality. In addition, the measures of women's expectations for men as partners and parents were designed for the current study (as needed to test our hypotheses) and thus do not have established construct validity. Nonetheless, the correlations between the measures of women's expectations and other variables in our study indicate that these measures were working the way that they were intended to.

In addition, this study relied on a sample of women recruited online from across the United States. This procedure yielded an analytic sample that was demographically diverse and largely representative of the United States population (Humes, Jones, & Ramirez, 2011). However, a majority (66%) of women in the current study self identified as non-Hispanic and white. Some research suggests that rates of marriage and divorce vary across racial and ethnic backgrounds, with the highest rates of single-parenthood and marital instability observed among black women and the lowest rates among non-Hispanic white women (Raley, Sweeney, & Wondra, 2015). It is thus critically important for future research to elucidate the processes by which these disparities manifest (and are potentially perpetuated). Isolating the effects of fathers while methodologically controlling for environmental confounds may help identify familial factors that differentially affect women from racial and ethnic minority groups.

Conclusion

The present study utilized a differential sibling-exposure design to test for the effects of fathers on daughters' expectations for men while accounting for many genetic and environmental confounds that co-vary with paternal behavior. We predicted that these expectations would serve

as a psychological mediator of the effects of low paternal investment on daughters' sexual

behavior demonstrated in previous developmental research (e.g., Ellis et al., 2012; James et al.,

2012). By comparing outcomes experienced by older and younger sisters within-families, this

work provides support for exposure to low-quality paternal behavior (but not paternal absence)

lowering women's expectations for men as partners in adulthood. These results suggest that the

early and short-term sexual behavior observed among daughters who receive low paternal

investment may be driven by changes in their beliefs about men, and their expectations for

receiving meaningful long-term investment from prospective male partners.

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Footnotes

[1] The differential sibling-exposure design as previously implemented (e.g., Ellis et al., 2012; Tither & Ellis, 2008) accounts for birth order and spacing effects by comparing sister pairs from divorced/separated families with a control sample of sisters from biologically intact, two-parent families that are matched in their ages and age gaps. Sisters reared in intact families do not systematically differ in exposure to their fathers (their amount of differential exposure is effectively zero years). Thus, fathers in this context should not have a consistently stronger impact on older or younger daughters. Because past studies using this design did not reveal within-family differences in the effects of fathers on sisters from intact families, the current project focused on recruiting a larger sample of sisters from biologically divorced/separated families rather than allocating resources to recruit a control sample from intact families.

[2] Although the recruitment procedures targeted women ages 18 to 36 and sister pairs separated by an age gap of at least four years, the screening procedures used one sister's age and the age gap between sisters (in years) to estimate the ages of potential participants and, as such, were imprecise. As a result, two women outside of the desired age range and sister pairs with slightly less than a four-year age gap were able to pass screening and were invited to participate.

[3] The main dependent measures focused on women's expectations for the behavior of *male* partners. Although women were retained in the reported analyses regardless of sexual orientation, it is important to test the predicted effects among women who are potentially attracted to men. Therefore, we retested our primary findings excluding families in which one of the sisters reported no attraction to men or women (i.e., asexual women, $n = 3$) or an almost exclusive attraction to women (i.e., lesbian women, $n = 5$). The main results replicated in this sample. Relevant analyses are detailed in Supplemental file 4.

[4] Approximately half of the women in the current study participated in a follow-up experiment reported in DelPriore et al. (2018). Older sisters' negative indicators of paternal behavior (social deviance, harsh-coercive fathering) also overlap with data reported in that paper.

[5] We did not include an analogous measure of maternal social deviance. This study was designed to rigorously test the effects of differential exposure to fathers (i.e., presence-absence and the quality of their behavior) on daughters' outcomes. In this context, our assessment of maternal behavior was less comprehensive than our assessment of paternal behavior.

[6] An identical pattern of results was obtained whether the truncated or original score was included in subsequent analyses.

[7] These item were recoded as follows: (a) year; recoded: *0 = 0*, *1 = 1*, *2 = 2*, *3 = 3 or more*; (b) five years; recoded: *0 = 0*, *1 = 1*; *2 = 2 to 4*, *3 = 5 to 10*, *4 = 11 or more*; (c) ten years; recoded: *0 = 0*, *1 = 1*, *2 = 2 to 4*, *3 = 5 to 9*, *4 = 10 to 14*, *5 = 15 or more*; and (d) rest of life; recoded: *0 = 0*, *1 = 1*, *2 = 2 to 4*, *3 = 5 to 9*, *4 = 10 to 20*, *5 = 21 or more*.

[8] The "anticipated (future) number of sexual partners" variable was highly leptokurtic, given that the modal response for each constituent item was "1." This leptokurtosis was attenuated, but not eliminated, when the variable was combined with the measure of women's "past number of sexual partners." The final outcome measure ("number of sexual partners") was included only in mediation models tested using Hayes' (2013) PROCESS macro. The bootstrapping procedure implemented by this software to generate confidence intervals around the indirect effects is largely robust to assumptions about the shape of the sampling distribution (Hayes, 2009). Therefore, we did not apply any transformations to this score.

[9] Prior to hypothesis-testing, all continuous predictors (quality of paternal behavior and amount of differential exposure to father presence-absence) and outcome variables (women's

expectations for men as parents/partners and number of sexual partners) were standardized ($M =$ 0, $SD = 1$) to increase interpretability of the regression coefficients.

[10] In all but two families, the amount of differential exposure to fathers corresponded to the age gap between sisters (calculated in days, based on the sisters' birthdates). In the two families in which the sisters' age gap did not accurately reflect differences in their amount of exposure to their fathers, the amount of exposure was recoded to reflect this difference. Accordingly, these two variables (sisters' age gap and their amount of differential exposure to their father) were almost perfectly correlated ($r = .98$, $p < .001$). We use the recoded differential exposure variable in our primary analyses to capture more accurately the differences between sisters in their amount of exposure to their fathers while growing up.

[11] The emphasis of this analysis is on statistical mediation, as reports collected at a single time-point cannot adequately establish temporal mediation.

[12] The moderated mediation results persisted when controlling for whether women were married/living with someone versus not (95% CI [-.08, -.01]), as relationship status correlated with women's numbers of sexual partners.

[13]The current study also included a measure of women's beliefs about the transient nature of romantic relationships. This measure was initially included to provide a fuller assessment of women's tendency toward short-term sexual relationships (including their behavior, intentions, and beliefs); however, scores on this measure were only weakly correlated with the reported measure of women's number of sexual partners ($r = .10$ for older and $r = .06$ for younger sisters). Therefore, we tested a separate moderated mediation model including this measure as the outcome (Y) variable. The results persisted and are reported in Supplemental file 8.

Table 1. *Item-Total Correlations for Measure of Expectations for Men as Partners*

Item	Item-total correlations
1. Regularly spend his free time with you rather than doing other things or seeing other people	0.50
2. Make plans for the future, such as discuss living together, getting married, or having children	0.59
3. Share his income to help pay for things, such as transportation costs, food, or having a joint bank account	0.67
4. Regularly contribute financially to you or your relationship, in general	0.62
5. Regularly put effort into seeing you (such as traveling long distances or traveling often)	0.67
6. Have sex with other women while involved with you (**R**)	0.72
7. Do risky things like gambling and fighting (**R**)	0.53
8. Do risky things like unprotected sex and illicit drugs (**R**)	0.59
9. Regularly do favors for you or help you (such as lending money or running errands)	0.59
10. Lie to you about where he goes and who he spends time with (**R**)	0.76
11. Regularly try to encourage you and support you	0.72
12. Spend money on flashy things to draw attention to himself (**R**)	0.48
13. Restrict his relationships with other potential partners, such as not dating or having sex with other women	0.51
14. Go out drinking with friends when he could be spending time with you (**R**)	0.58

Note. **R** = Reverse-coded item. The measure was coded such that higher scores indicate greater expectations for men as relationship partners.

Table 2. *Correlations Between Quality of Parental Behavior, Women's Number of Sexual Partners, and Expectations for Men*

Measure	1	2	3	4	5	6
1. Paternal social deviance	−	-.57***	-.13	.10	-.22***	-.19**
2. Paternal warmth/involvement	-.55***	−	.27***	-.03	.33***	.15*
3. Maternal warmth/involvement	-.01	.01	−	-.01	.08	.14*
4. Number of sexual partners	-.002	-.01	.07	−	-.09	-.27***
5. Expectations for men as parents	-.12	.26***	.12	-.01	−	.40***
6. Expectations for men as partners	.02	-.004	.16*	-.16*	.31***	−

Note: Older sisters (*n*s = 215-222) are above the diagonal, and younger sisters (*n*s = 217-222) are

below the diagonal. Significance tests are two-tailed. **p* ≤ .05. ***p* ≤ .01. ****p* ≤ .001.

Table 3. *Summary of Models Testing the Effects of Exposure to Paternal Presence-Absence and*

Quality of Paternal Behavior on Daughters' Expectations for Men as Parents and as Partners

Hypothesis	Expectations for Men as Parents	Expectations for Men as Partners
Social Address (Exposure to Paternal Presence-Absence)	Effect of differential exposure indexed by birth order: Not supported Effect of differential exposure indexed by birth order and years: Not supported	Effect of differential exposure indexed by birth order: Not supported Effect of differential exposure indexed by birth order and years: Not supported
Exposure to Quality of Paternal Behavior: Paternal Social Deviance	Effects of differential exposure (indexed by birth order) to quality of paternal behavior: Not supported Effects of differential exposure (indexed by birth order and years) to quality of paternal behavior: Not supported	Effects of differential exposure (indexed by birth order) to quality of paternal behavior: Supported Effects of differential exposure (indexed by birth order and years) to quality of paternal behavior: Not supported
Exposure to Quality of Paternal Behavior: Paternal Warmth/Involvement	Effects of differential exposure (indexed by birth order) to quality of paternal behavior: Not supported Effects of differential exposure (indexed by birth order and years) to quality of paternal behavior: Not supported	Effects of differential exposure (indexed by birth order) to quality of paternal behavior: Qualified support (interaction: $p = .09$) Effects of differential exposure (indexed by birth order and years) to quality of paternal behavior: Not supported
Moderated Mediation Model Predicting Number of Sexual Partners	Not tested	Supported

Table 4. *Parameter Estimates (and Standard Errors) for Models Predicting Daughters'*

Expectations for Men as Partners

	Parameter Estimates (SE)					
Predictors	Social Address		Paternal Social Deviance		Father Warmth/Involvement	
Main Effects						
BthOrd	.09 (.09)	.09 (.09)	.09 (.09)	.09 (.09)	.09 (.09)	.09 (.09)
PaternalQual			-.19 (.07)**	-.19 (.07)**	.16 (.07)*	.15 (.07)*
Exposure		.04 (.07)		.04 (.07)		.03 (.07)
Two-way interactions						
PaternalQual x BthOrd			.22 (.09)*	.21 (.09)*	-.16 (.09)	-.15 (.09)
PaternalQual x Exposure				-.02 (.06)		.03 (.06)
BthOrd x Exposure		-.01 (.09)		-.01 (.09)		-.002 (.09)
Three-way interaction						
PaternalQual x BthOrd x Exposure				.03 (.08)		-.03 (.09)

Note. $N = 223$ sister pairs (446 individuals). Birth order of sisters (0 = older, 1 = younger). All

other main effects are continuous and mean centered. BthOrd, birth order of sisters; Exposure,

differential exposure to fathers between sisters; PaternalQual, quality of paternal behavior (i.e.,

paternal social deviance or father warmth/involvement)
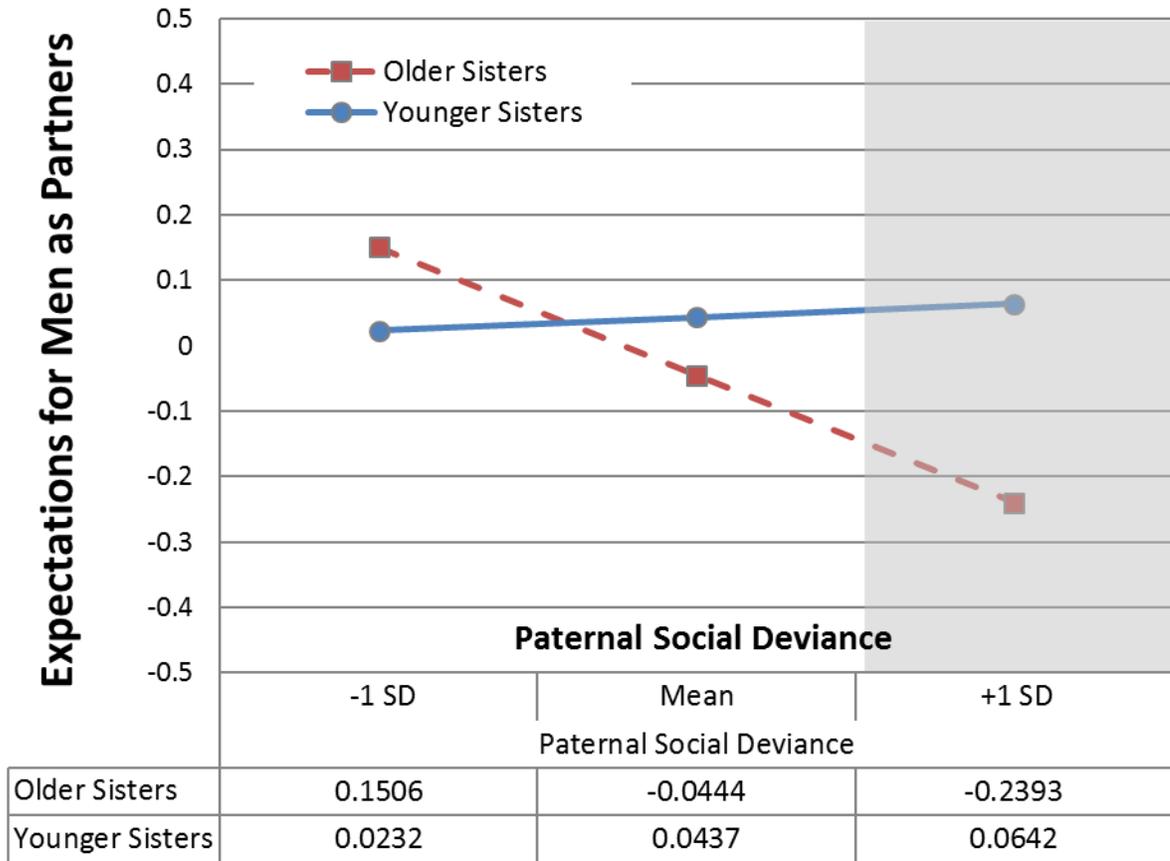
*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

Figure 1. The effects of paternal social deviance on daughters' expectations for men as partners. Measures are standardized. The numbers at the bottom of the figure reflect the predicted values for women's expectations at mean (0), low (1 *SD* below the mean), and high (1 *SD* above the mean) paternal social deviance for older and younger sisters. The shaded area indicates the levels of paternal social deviance wherein significant differences in expectations were obtained between older and younger sisters.
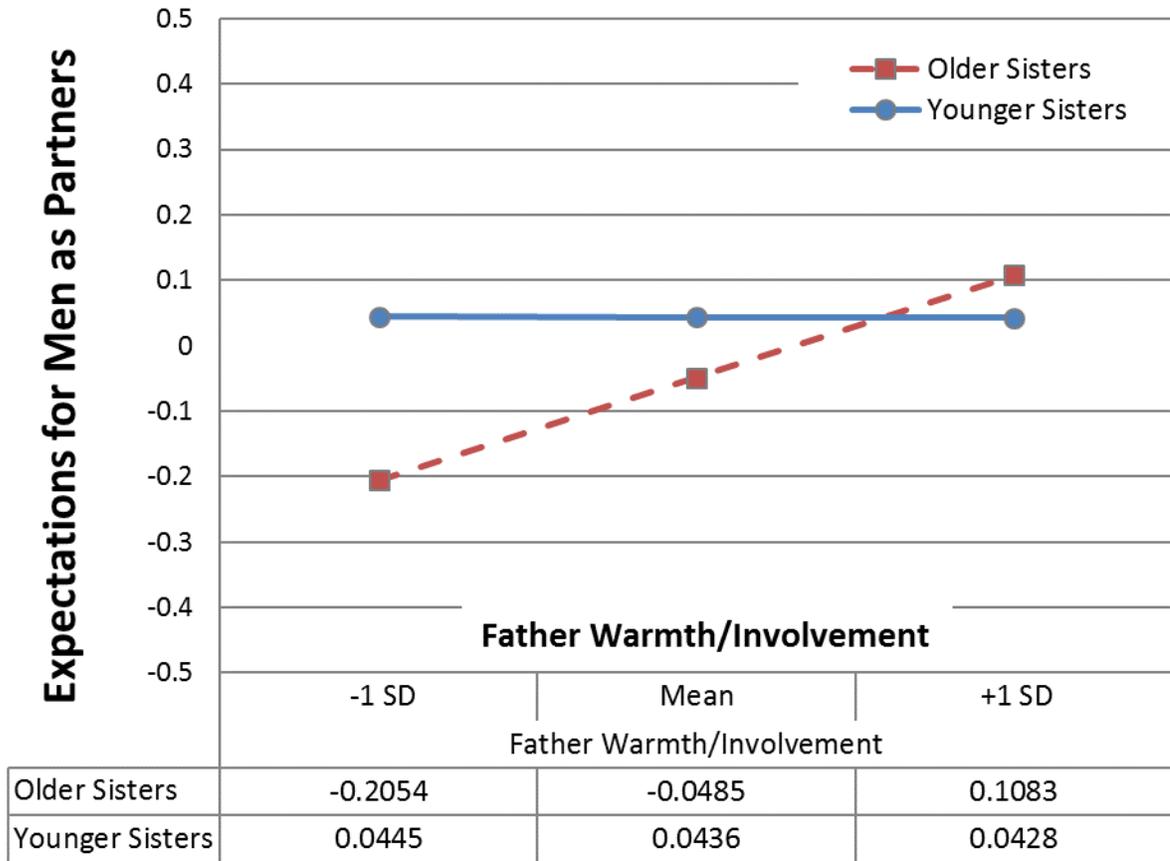
	-1 SD	Mean	+1 SD
Older Sisters	-0.2054	-0.0485	0.1083
Younger Sisters	0.0445	0.0436	0.0428

Figure 2. The effects of father warmth/involvement fathering on daughters' expectations for men as partners. Measures are standardized. The numbers at the bottom of the figure reflect the predicted values for women's expectations at mean (0), low (1 *SD* below the mean), and high (1 *SD* above the mean) father warmth/involvement for older and younger sisters.
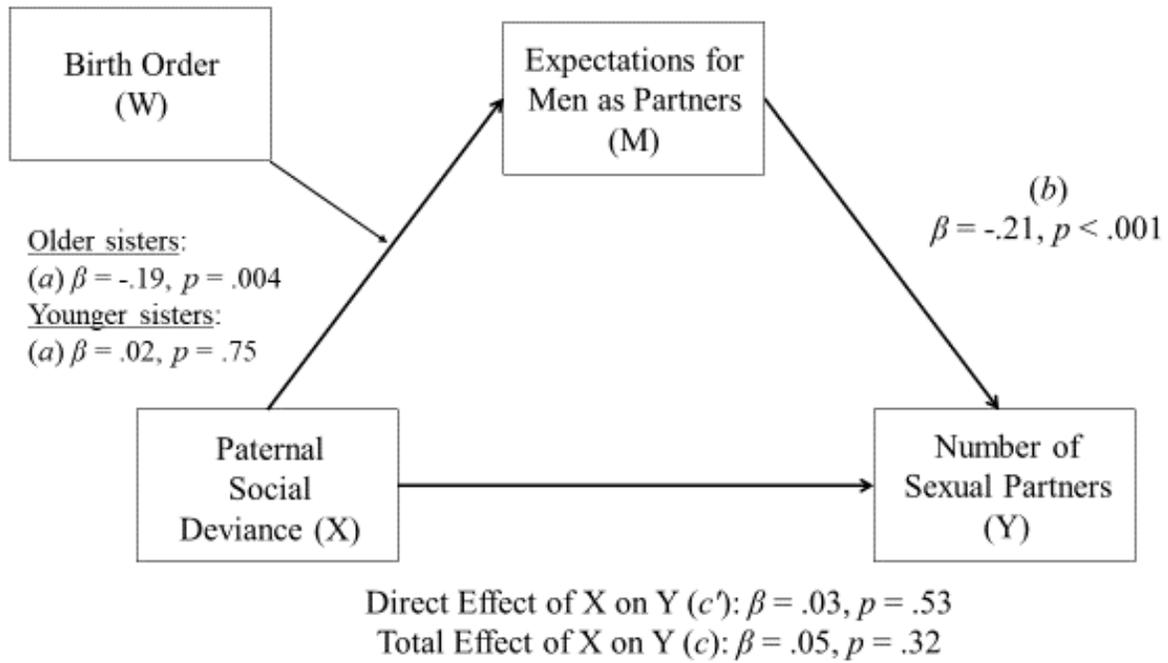
Figure 3. Moderated mediation analysis of the effects of paternal social deviance (X) on

daughters' number of sexual partners (Y). Mediating effect of expectations for men as partners

(M) was moderated by birth order of the sisters (W). Indirect effect of X on Y through M

moderated by W: b = -.05 (SE = .02), 95% CI [-.10, -.01]. The mediating relationship was

statistically significant for older sisters (95% CI [.01, .08]) but not for younger sisters (95% CI [-

.03, .02]).